



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|---------------------|------------------|
| 10/691,403 | 10/21/2003 | Christophe Maleville | 4717-11700 | 6835 |
| 28765 | 7590 | 11/16/2005 | EXAMINER | |
| WINSTON & STRAWN LLP 1700 K STREET, N.W. WASHINGTON, DC 20006 | | | PERALTA, GINETTE | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2814 | |

DATE MAILED: 11/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

EK

| | | | |
|------------------------------|--------------------------------------|---|--|
| Office Action Summary | Application No. 10/691,403 | Applicant(s) MALEVILLE ET AL. | |
| | Examiner Ginette Peralta | Art Unit 2814 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 August 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-28 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-24 and 26-28 is/are rejected.
- 7) ☐ Claim(s) 25 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tiwari (U. S. Pat. 6,600,173 B2) in view of Barge et al. (WO 01/15215 A1), as previously applied.

Regarding claim 1, Tiwari discloses a method for producing a high quality useful layer of semiconductor material on a substrate that comprises implanting at least two different atomic species into a face of a donor substrate 10 to a controlled mean implantation depth to form a weakened zone therein and to define a useful layer, as disclosed in col. 2, line 57- 64; bonding a support substrate 20 to the face of the donor substrate 10, as disclosed in col. 2, lines 64-67; detaching the useful layer 14 from the donor substrate 10 along the weakened zone to form a structure that includes the useful layer 14 on the support substrate 20 with the useful layer presenting a surface 15 for further processing, as disclosed in col. 3, lines 1-11. Furthermore, Tiwari discloses that the purpose of its method is to provide a surface that is atomically smooth.

Tiwari discloses the claimed invention with the exception of thermally treating the structure to minimize high frequency roughness of the surface.

Barge et al. discloses a method for producing a high quality useful layer of semiconductor material on a substrate that comprises implanting an atomic species into a face of a donor substrate to a controlled mean implantation depth to form a weakened zone therein and to define a useful layer, as disclosed in Page 11, lines 11-34; bonding a support substrate to the face of the donor substrate, as disclosed in page 12, lines 5-20; detaching the useful layer from the donor substrate along the weakened zone to form a structure that includes the useful layer on the support substrate with the useful layer presenting a surface for further processing, as disclosed in page 12, lines 21-27; and thermally treating the structure to minimize high frequency roughness of the surface of the useful layer to thus provide a surface having sufficient smoothness so that chemical mechanical polishing of the useful layer surface is not required, which is disclosed in page 12, lines 33-35, page 15, lines 25-39, and page 16, lines 19-26, where it is shown that after the annealing step the roughness measured during scanning of a $1 \times 1 \mu\text{m}^2$ area is reduced from 50 to 1-1.5 Å rms and the roughness measured during scanning of a $10 \times 10 \mu\text{m}^2$ area is reduced from 50 to 5-15 Å rms.

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to thermally treat the structure of Tiwari for the disclosed intended purpose of Barge et al. of producing a high quality useful layer with a significant reduction in high frequency and low frequency roughness, as disclosed in page 16, lines 19-26 of Barge et al. and furthermore that Barge et al. discloses that the high frequency roughness is minimized sufficiently that a chemical mechanical

polishing is not required, but it further enhances the structure and is used to further reduced the low frequency roughness to a satisfactory value, which is achieved by Tiwari by the dual ion implantation, thus the chemical mechanical polishing step is not required at all.

Regarding claim 2, Tiwari discloses in col. 2, lines 61-64 that the different species comprises hydrogen species and helium species.

Regarding claim 3, Tiwari disclosed in col. 2, lines 61-64 that the method further comprises sequentially implanting the hydrogen and helium species.

Regarding claim 4, Tiwari discloses in col. 2, lines 61-64 and in col. 4 lines 66-67 that the hydrogen is implanted before the helium and that the helium and hydrogen are co-implanted, but does not explicitly disclose that the helium is implanted before the hydrogen, but since the method benefits of the implantation of the two species, it would have been obvious to one of ordinary skill in the art at the time the invention was made to implant the helium before the hydrogen.

Regarding claims 5 and 26, Tiwari discloses that the helium species is implanted at a dose of between about $1 \times 10^{16} \text{ cm}^{-2}$ and about $4 \times 10^{16} \text{ cm}^{-2}$. It would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the dose of the helium species until a desired result is obtained, as there is no statement denoting the criticality of implantation dose, and Tiwari discloses a range that overlaps with the claimed range.

"In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of "about 1-5%" while the claim was limited to "more than 5%." The court held that "about 1-5%" allowed for concentrations slightly above 5% thus the ranges overlapped.)" (MPEP 2144.04)

Regarding claims 6 and 27, Tiwari discloses that the hydrogen species is implanted at a dose of between about $1 \times 10^{16} \text{ cm}^{-2}$ and about $4 \times 10^{16} \text{ cm}^{-2}$. It would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the dose of the helium species until a desired result is obtained, as there is no statement denoting the criticality of implantation dose, and Tiwari discloses a range that overlaps with the claimed range.

"In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of "about 1-5%" while the claim was limited to "more than 5%." The court held that "about 1-5%" allowed for concentrations slightly above 5% thus the ranges overlapped.)" (MPEP 2144.04)

Regarding claim 7, Tiwari as modified by Barge et al. above discloses that the thermal treatment is a rapid thermal annealing process carried out at a temperature of at least 1000°C , preferably between about 1100 and 1230°C , as disclosed in page 15, lines 15-33, and page 18, lines 16-18. . It would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the temperature of the thermal treatment until a desired result is obtained as there is no statement denoting the

criticality of the temperature, and as Tiwari as modified by Barge et al. discloses a range that overlaps with the claimed range.

"In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of "about 1-5%" while the claim was limited to "more than 5%." The court held that "about 1-5%" allowed for concentrations slightly above 5% thus the ranges overlapped.)" (MPEP 2144.04)

Regarding claim 8, Tiwari as modified by Barge et al. above, further discloses in page 15, lines 16-20 that the rapid thermal annealing process is carried out for a duration of about 20 seconds. It would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the duration of the thermal treatment until a desired result is obtained as there is no statement denoting the criticality of the duration, and as Tiwari as modified by Barge et al. discloses a duration that lies within the claimed range of 1 to about 60 seconds.

"In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of "about 1-5%" while the claim was limited to "more than 5%." The court held that "about 1-5%" allowed for concentrations slightly above 5% thus the ranges overlapped.)" (MPEP 2144.04)

Regarding claims 9-11 and 28, Tiwari, as modified by Barge et al. above, further discloses that the rapid thermal annealing process is conducted in an atmosphere containing a mixture of argon and hydrogen or the pure gases as disclosed in page 5, lines 8-24, and page 15, lines 9-12.

Regarding claim 12, Tiwari discloses in col. 3, lines 12-21, and Barge et al. in page 5, lines 34-39 that a stabilized oxidation process is conducted on the substrate.

Regarding claim 13, Tiwari as modified by Barge et al. discloses that the stabilized oxidation process comprises the successive implementations of an oxidation operation, an annealing operation and a deoxidation operation, as disclosed by Barge et al. in page 17, lines 27-30.

Regarding claim 14, Tiwari, as modified by Barge et al., further discloses that the annealing operation is conducted at a temperature of about 1100 to 1200°C but does not disclose the duration of the annealing step. . It would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the duration of the annealing step until a desired result is obtained as there is no statement denoting the criticality of the duration, and Tiwari as modified by Barge et al. discloses the cycle of the annealing along with the oxidation and deoxidation steps.

"In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of "about 1-5%" while the claim was limited to "more than 5%." The court held that "about 1-5%" allowed for concentrations slightly above 5% thus the ranges overlapped.)" (MPEP 2144.04)

Regarding claim 15, Tiwari as modified by Barge et al. discloses conducting a rapid thermal annealing process on the structure prior to the stabilized oxidation process, as disclosed above and as disclosed in page 17, lines 12-17 of Barge et al..

Regarding claim 16, Tiwari as modified by Barge et al. discloses conducting a plurality of rapid thermal annealing and stabilized oxidation processes on the structure as disclosed in page 17, lines 12-17, and page 20, line 20- page 21, line 4 of Barge et al..

Regarding claim 17, Tiwari, as modified by Barge et al., discloses the stabilized oxidation operation being conducted prior to thermally treating the structure as disclosed by Barge et al. in page 20, lines 20-25.

Regarding claim 18, Tiwari as modified by Barge et al. discloses conducting a plurality of rapid thermal annealing and stabilized oxidation processes on the structure as disclosed in page 17, lines 12-17, and page 20, line 20- page 21, line 4 of Barge et al..

Regarding claim 19, Tiwari, as modified by Barge et al., discloses at least one simple oxidation operation including an oxidation operation followed by a deoxidation operation of the structure as disclosed by Barge et al. in page 17, lines 27-30.

Regarding claim 20, Tiwari as modified by Barge et al. discloses conducting a rapid thermal annealing process on the structure prior to the simple oxidation process, as disclosed above and as disclosed in page 17, lines 12-17 of Barge et al..

Regarding claim 21, Tiwari as modified by Barge et al. discloses conducting a plurality of rapid thermal annealing and simple oxidation processes on the structure as disclosed in page 17, lines 12-17, and page 20, line 20- page 21, line 4 of Barge et al..

Regarding claim 22, Tiwari, as modified by Barge et al., discloses the simple oxidation operation being conducted prior to thermally treating the structure as disclosed by Barge et al. in page 20, lines 20-25.

Regarding claim 23, Tiwari as modified by Barge et al. discloses conducting a plurality of rapid thermal annealing and simple oxidation processes on the structure as disclosed in page 17, lines 12-17, and page 20, line 20- page 21, line 4 of Barge et al..

Regarding claim 24, Tiwari as modified by Barge et al. discloses that the different atomic species are implanted so that the useful layer surface is provided with a low-frequency roughness of less than about 5 Å after the detachment of the useful layer at the weakened zone without chemical mechanical polishing, as disclosed by Barge et al. in page 16, lines 19-26.

"In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of "about 1-5%" while the claim was limited to "more than 5%." The court held that "about 1-5%" allowed for concentrations slightly above 5% thus the ranges overlapped.)" (MPEP 2144.04)

Allowable Subject Matter

3. Claim 25 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The primary reason for the allowance of the claims is the inclusion of the feature that the useful layer is provided with a low frequency roughness of less than about 5Å measured over a sweep area of about 40x40 μm² after the detachment of the useful layer at the weakened zone without chemical mechanical polishing which is not anticipated nor rendered obvious over the prior art of record.

Response to Arguments

4. Applicant's arguments filed 8/3/05 have been fully considered but they are not persuasive.

Regarding applicant's argument that both Barge and Tiwari teach that polishing is required to provide an acceptable surface, and that there is in fact no suggestion to one of ordinary skill in the art that the methods of these two references could be combined to eliminate the polishing step, it is noted that the claim language states that the structure is thermally treated to minimize high frequency roughness so that the polishing is not required, but the claim language does not preclude that a polishing step may take place afterwards since the claim is open ended. Furthermore, it is noted that the method of Barge discloses the polishing step to further improve the surface by further reducing the low frequency roughness which has already being reduced by the implantation and thermal treatment to 1-1.5 Å on a 1x1 µm² scanned surface area, and the claim language recites that "thermally treating the structure to minimize high frequency roughness of the useful layer surface to thus provide sufficient smoothness so that chemical mechanical polishing is not required" therefore Barge performs the CMP operation for a different purpose and the claim language does not preclude the presence of a polishing step it just states that it is not required, not that it should not be performed at any time in the process.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ginette Peralta whose telephone number is (571) 272-1713. The examiner can normally be reached on Monday to Friday 8:00 AM- 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

GP

Wael Halmy
SPE 2814